part of the cable network, or a third party can own part of both. Putting aside the third possibility, the FCC's proposed rules treat the first two situations completely symmetrically. The sale of a cable network to a cable system is treated as an affiliate transaction either if the cable operator owns at least 5% of the cable network or the cable network owns at least 5% of the cable operator.

These two situations are not identical and they should not necessarily receive identical regulatory treatment. What is at stake in these regulations is the price charged by a cable network to a cable operator. While the two parties might bargain, the price is ultimately a decision of the cable network and is presumably made to maximize the value of the network (or the company that owns the network). When a cable network owns part of a cable operator, it has an incentive to consider the effect of the price it charges on the cable operator's profits. When a cable operator owns part of a network, the effect is less clear. In theory, the managers of the network have a fiduciary responsibility to maximize the stand-alone value of the network (or the value of the company that owns all of the network). In practice, of course, the cable operator might be able to influence the network's decisions. To analyze how it might do so, one needs to compare the price that would maximize network value to the price that would maximize the value of the cable operator. If the cable operator would be made better off by a lower price than the one that maximizes network value, then the likely effect, if any, of the cable operator's stake would be to lower the price. If the cable operator would be made better off by a higher price than the one that maximizes the network's value, then the likely effect, if any, of the cable operator's stake would be to increase the price. This paper analyzes the case when a cable operator owns part of a cable network.[3]

The proposed limitation on the use of the prevailing price rule seems to be based on a concern that any vertical affiliation provides an incentive to use the price of the intermediate good (the cable network price in this case) to circumvent price regulations. Unless a cable operator's share of a cable network is very large, this concern is completely misplaced. When vertical integration is used to circumvent price regulations, it does so by transferring potential (absent regulation) profits from a regulated stage to an unregulated stage. When a cable operator owns all of a cable network, it is generally indifferent about whether it "earns" (or, more accurately, reports) its profits at the network stage or at the cable stage. When a cable operator owns only part of a cable network, it is not indifferent about the stage at which profits are earned.

A simple example illustrates this very fundamental point. Consider a cable operator with 1 million subscribers. Furthermore, suppose:

1. The cable operator has a share in a cable network that it offers on its systems.

2. The network is carried on some unaffiliated systems as well. Its subscriber fee to those networks is $1.00. This price maximizes the network's profits from selling to unaffiliated cable operators.

3. A price of $20 for basic service would maximize the joint profits of the cable operator and the network.

4. Because of price regulation, the cable operator is only allowed to charge $15.

5. Other than the price of the network with which it is affiliated, the marginal cost to the cable operator of an additional subscriber is $4.00.

[3] It does not analyze the case when a cable network owns part of a cable operator.

6. If the network with which the cable operator is affiliated increases its price above \$1.00, the cable operator can pass the price increase through (on a dollar-for-dollar) basis to the price it charges for basic service. Similarly, the cable operator must pass through any reduction in the price of the network below \$1.00 to final consumers.

Would the cable operator like the network to increase its price, decrease it, or keep it the same? Ignoring any fixed costs, the cable operator's profits (from its cable operations) are \$10 million.[4] The network's profits from selling to its affiliated system are \$1 million.[5] Because the price regulations in fact constrain the cable operator (Assumptions 3 and 4), an increase in the price of the cable network to \$2.00, which in turn would permit the cable operator to raise its price to \$16, would increase the *combined* profits of the two firms.

An increase in combined profits is not, however, sufficient for the profits of both the network and the cable operator to increase. The increase in the price of basic service would cause some reduction in demand. Suppose that at a price of \$16, the cable operator would have 950,000 subscribers. With this new set of prices, the cable operator's profits from its cable operations drop to \$9.5 million. The network's profits from selling to the affiliated cable operator rise to \$1.9 million. If the cable operator owned all of the network, it would only be concerned with the sum of the profits from the two stages. The \$900,000 increase in network profits would more than offset the \$500,000 reduction in the profits from its cable operations. This example illustrates how complete vertical integration can be used to circumvent price regulations and why a prevailing price rule is not always appropriate.

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[4] It nets \$10 per customer and has one million customers. The \$10 net is the difference between the \$15 price and the per subscriber costs, which in turn consist of the \$4.00 of other costs and \$1.00 subscriber fee to the network with which the cable operator is affiliated.

[5] It charges \$1.00 and the number of subscribers is 1 million.

In this example, however, the cable operator does not necessarily own all the network. Suppose, for example, that it owns 1/3 of the network. In that case, it would be made worse off by the increase in the price of the network. It would lose the full $500,000 from its cable operations and only gain 1/3 of the $900,000 profits at the network stage. On net, therefore, it would lose $200,000. Rather than pushing for an increase in the price of the network, it would benefit from a decrease. Under such circumstances, a prevailing price rule would induce the cable network to try to influence the network to lower its price.

As should be clear from the above example, the interests of the cable operator turn critically on its share of the cable network. If its share is greater than 5/9, it would benefit from the increase in the price of the network. If its share is less than 5/9, it would be made worse off by the price increase. If its share is exactly 5/9, it is indifferent.[6]

The value of 5/9 (or, roughly, 55.6%) for what we can call the "critical ownership share" in this example is not completely general. The technical appendix shows that the critical ownership share can be written as a function of four factors: the elasticity of demand for basic

[6] One might suspect that a change in the price of the network would change the network's profits from selling to non-affiliated cable operators. The assumption that $1.00 is the price that maximizes those profits has two implications. First, any small change in price around $1.00 (say to $1.01 or to $0.99) would have a negligible effect on the profits from sales to non-affiliates. (As is discussed in section VI, this implication requires some additional assumptions. The failure of those assumptions expands the conditions under which there is no potential harm from a prevailing price rule.) Second, any larger change in price, either positive or negative, would cause those profits to drop. This example hypothesizes a price increase from $1.00 to $2.00. Such an increase is too large for the effect on profits from sales to non-affiliates to be negligible. The argument that a cable operator with a 1/3 share of the network would be made worse off by the increase is still correct, however. In fact, the cable operator's share of the reduced profits from selling to non-affiliates reinforces it.

cable service at the price that maximizes the joint profits of the cable operator and the network,[7] the elasticity of demand at the regulated price, the ratio of the network price to the price of basic,[8] and the percent reduction in the price of basic due to regulation.[9] This set of determining factors is not unique. It is chosen because we can obtain plausible values for each of these factors.

I know of two recent estimates of the elasticity of demand for cable television service. Using 1982 data, Mayo and Otsuka[10] obtain a range of estimates from -0.70 for systems outside ADI markets[11] to -1.51 for systems in top 50 ADI markets with an average of -0.97. Using a data base that included only cable systems in large cities, Rubinovitz[12] estimated a demand elasticity of -1.46. In what follows, an elasticity of -1.5 will be taken as the base case. For comparison sake, estimates will also be presented for elasticities (at the monopoly price) of -1.2

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[7] The elasticity of demand is defined as the ratio of the percentage change in the quantity demanded divided by the percentage change in price (for an infinitesimal change in price). It is negative because an increase in price causes a reduction in the quantity demanded.

[8] Again, some additional precision is in order. The network price is the one that maximizes profits from sales to non-affiliated systems. The price of basic is the one that maximizes the joint profits of the network and cable operator from sales in the cable operator's service area.

[9] Again, the same price of basic is the one that maximizes the joint profits of the cable operator and network from sales in the cable operator's service territory.

[10] Mayo, John and Yasuji Otsuka, "Demand, Pricing, and Regulation: Evidence from the Cable TV Industry," *The Rand Journal of Economics*, vol. 22, Autumn, 1991, pp. 396-410.

[11] ADI stands for "Area of Dominant Influence."

[12] Rubinovitz, Robert N., "Market Power and Price Increases for Basic Cable Service Since Deregulation," *The Rand Journal of Economics*, Volume 24, Spring, 1993, pp. 1-18.

and -2.[13]

The FCC benchmark price caps entail a 17% price reduction. Thus, we can take the ratio of the regulated price to the monopoly price to be .83.[14]

If the demand curve has constant elasticity, then the demand at the regulated price equals the demand at the joint profit-maximizing price. It is plausible, though, that the demand curve is less elastic at lower prices. In addition to the constant elasticity case, therefore, we will consider the case where the elasticity is 1/2 as great at the regulated price as at the joint profit-maximizing price and where it is 3/4 as great. The less elastic demand is at the regulated price, all else equal, the smaller the critical ownership share. In the extreme where demand is perfectly inelastic, the critical ownership share would be 0 because the cable operator would not be at all harmed by a cost increase that it could pass through.

The subscriber fees charged by networks to cable operators range from a few cents to roughly $0.50, with the vast majority being below $0.25. A plausible range for the profit-maximizing price of basic cable service is $10 to $30. Thus, the ratio of the price of the network to the joint profit-maximizing price might range anywhere from 0 to 0.05. When this ratio is high, the price charged by the network eats into the profit margin of the cable operator. The lower the cable operator's margin, the less it objects to price increases that reduce demand.

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[13] In a more elaborate model that took account of the effect of the price of basic cable service on subscriptions to pay cable services, the elasticity at the monopoly price could be less than -1 in absolute value. Within the context of this model, however, it simply makes no sense to consider such elasticities.

[14] Actually, it might be somewhat lower. The 17% reduction is on the price that maximizes the cable operator's profits, which would generally be somewhat greater than the price that maximizes the joint profits of the network and the cable operator.

As a result, a high value for this ratio lowers the critical ownership share. Since the critical ownership share is not particularly sensitive to this ratio in the plausible range of the other parameters, all of the reported results are based on a single value, 0.05.

Table 1 reports the critical ownership shares for the different values of the elasticities at the monopoly price and at the regulated price. They range from 0.36 to 0.96. They are above 0.65 (65% when stated in percentage terms) unless one of two conditions is present. Either the elasticity at the monopoly price is -2.0 or the elasticity is half as great at the regulated price as at the (17% higher monopoly price). Neither of these two conditions is particularly likely to hold.

IV

The Effect of the 7.5% Pass-Through

The above analysis was based on the assumption that the regulations allow a cable operator to pass programming costs through to its prices on a dollar for dollar basis. In fact, they are allowed to add a 7.5% mark-up to these costs. The mark-up makes price increases somewhat more palatable to cable operators, but the effect is likely to be small.

Consider the example in the previous section but modify Assumption 6 so that the operator can raise its price by $1.075 in response to the $1.00 increase in the price of the network.[15] Since the price is somewhat higher, demand would drop. If the demand curve is

[15] In reality, of course, a cable operator is limited to prices that are multiples of $.01. Since the price regulations are caps, the operator might only be able to raise its price by $1.07. If the effect of a 7.5% pass is small, then the effect of a somewhat smaller pass through is smaller still.

linear, then demand would drop to 946,250.[16] The profits from the cable operations would be $10.075 x 946,250 = $9,533,469, which is $466,532 less than the $10,000,000 earned when the price of the network is $1. The network's profits from sales to this cable operator would be $2 x 946,250 = $1,892,500, which is $892,500 greater than when the price of the network is $1. The cable operator benefits from the price increase if its share of the network exceeds $466,532 / $892,500 = .523 or, in percentage terms, 52.3%. This critical ownership share is smaller but not much smaller than the 55.6% found in Section III.[17]

Table 2 is similar to Table 1 except that it incorporates the effect of the 7.5% mark-up. The values in Table 2 are virtually identical to those in Table 1, which means that the 7.5% mark-up does not affect the critical ownership share much in the plausible range of the other parameters. Again, unless the elasicity at the monopoly price is -2 or the elasticity at the regulated price is half the elasticity at the monopoly price, the critical share value is at least 62%.

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[16] Along a linear demand curve, the slope, which is the ratio of the change in quantity to the change in price, is constant. Since a price increase from $15 to $16 causes demand to drop from 1,000,000 to 950,000, the slope of the demand curve is -50,000. An additional $.075 price increase therefore causes demand to drop by .075 x 50,000 = 3,750. At a price of $16.075, therefore, demand is 950,000 - 3750 = 946,250. Demand curves are not necessarily linear, but the 7.5% pass through has only a small effect on a cable operator's incentives is not likely to be sensitive to this assumption.

[17] The 7.5% mark-up would have a big impact on the critical ownership share if the price regulations were so tight that the margin on basic cable service was very small. Under such circumstances, the reduction in the number of subscribers would not lower the profits from cable operations very much, so even a small share of the increased network profits would compensate the cable operator. Because the difference between price and marginal cost remains substantial even under the new price regulations, the effect of the mark-up is likely to be small.

V

Multiple Cable Operators with Ownership Shares

Many cable networks have more than one cable operator as shareholders. In applying the above analysis, therefore, it is important to assess whether the critical ownership share applies to the shares of individual cable operators or to the sum of the shares of all cable operators.

Suppose all the cable operators with shares in a network merged. The combined entity would be one firm and its share would be the sum of the shares of the merging parties. The above analysis would then apply, and the effect of a prevailing price rule would turn on whether the combined shares exceeded the critical ownership share. This argument establishes that when the sum of the shares exceeds the critical ownership share, it would be in the combined interest of the cable operators to have a higher price of the network.

Suppose that the critical ownership share is 60% and that two cable operators each own 40% of the cable network. If the network raises its price, the profits of the network increase and the profits of the cable operators from their cable operations drop. Indeed, the 60% critical ownership share means that every $1.00 reduction in a cable operator's profits is associated with a $1.67 increase in the network's profits.[18] With only a 40% share of the network, the cable operator is made worse off by the combination of a $1.00 decrease in its cable profits and the associated $1.67 increase in the network's profits. Its 40% share of the $1.67 is only $0.67.

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[18] The $1.67 is calculated as $1.00/.6. (The .6 is the critical share value stated as a fraction.)

However, the cable operator also gets 40% of the increased network profits from raising the price to the other affiliate. If the other affiliate's cable operations are the same size, then it gets a total of $1.33 in increased network profits for every $1.00 reduction in its cable profits.

More generally, suppose there are N cable operators affiliated with a network. Let s_i be affiliate i's share of the cable network. Let r_i be the number of basic subscribers of affiliate i divided by the total cable subscribers for all of the affiliates. Cable operator i benefits from an increase in the price of the network if s_i/r_i exceeds the critical share value, subject to the qualification discussed below. It is possible, of course, that this condition would be true for some affiliates and not for others. If so, the shares of those operators with an incentive to lower prices should be ignored in calculating whether the share of cable operators exceeds the critical ownership share. When they are, then r_i would have to be re-calculated. There should only be concern about the prevailing price rule if there is a group of affiliates who each have an interest in raising the price of the network and whose combined share exceeds the critical ownership share.[19]

The following three cases illustrate how this would work. Case 1 is an example in which three firms have a mutual interest in increasing prices. Case 2 is an example in which there would not be pressure to raise prices even though the combined shares of the affiliates exceed the critical ownership share. Case 3 is an example in which the combined share of three affiliates exceeds the critical ownwership share, one of the affiliates would like a lower price for the network, and the other two would like a higher price. In the first two, the critical ownership

[19] Actually, this second condition is redundant. If there is a group for which all of the operators have an interest in higher prices, then their combined share must exceed the critical ownership share.

share is 65% (or, stated as a fraction, 0.65) and there are three cable operators with 25% (or, stated as a fraction, 0.25) ownership shares each. In case 1, each owner has 10% (or 0.10) of the subscribers to the network. In aggregate therefore, the three affiliated operators have 30% (or 0.30) of the subscribers. For each operator, therefore, r_i equals 0.10/0.30 = 1/3. As a result, s_i/r_i = 0.25/(1/3) = 0.75 for all three. In this case, all three would benefit from an increase in the price of the network, subject to the qualification discussed below.

In case 2, the ownership shares are the same, but operator 1 accounts for 12% (or 0.12) of the subscribers while operators 2 and 3 account for 6% (or 0.06) each. The affiliated cable operators account, therefore, for 24% of the subscribers. Of this 24%, operator 1 has half. Thus, r_1 = 0.5 and r_1/s_1 = 0.25/0.5 = 0.5, which is less than the critical ownership share of 0.65. Thus, operator 1 would not be part of what might be termed a "price raising coalition." Having excluded operator 1, one would then evaluate whether operators 2 and 3 form a price raising coalition. They clearly do not, since their combined share is 50%, which is less than the critical ownership share of 65%.

In case 3, the assumptions are the same as in case 2 except that cable operator 1 has only a 5% (or 0.05) ownership share while operators 2 and 3 have 35% (or 0.035) each. Viewing the three affiliates as a group, r_1/s_1 = 0.05/0.5 = 0.1 and r_2/s_2 = r_3/s_3 = 0.35/0.25 = 1.4. Because r_1/s_1 is less than the critical ownwership share, operator 1 would not be part of a price raising coalition. One would then evaluate whether operators 2 and 3 are part of a price raising coalition. To do so, s_2 and s_3 must be re-evaluated. Together, operators 2 and 3 have a combined 12% (or 0.12) of the subscribers. Thus, the new values of s_2 and s_3 (which we can label s_2' and s_3') are 0.06/0.12 = 0.5. Next, calculate r_2/s_2' = r_3/s_3' = 0.35/0.5 = 0.7, which exceeds the critical ownership share of 0.65. Thus, operators 2 and 3 are a price raising coalition. How successful they would be raising the price of the network would, of course, depend on how much influence operator 1 would have, since operator 1 would prefer a lower price.

Even if all or some of the affiliates constitute a price-raising coalition, the increase in the price of the network that could be sustained might be limited. The analysis of the critical share value rests on the assumption that all affiliates will continue to carry the network regardless of the price. If a substitute network exists, however, an affiliate might simply drop the network.

To summarize, therefore, cable operator ownership in cable networks is less likely to result in a price increase when the ownership is split among more than one operator than when the same share is controlled by a single operator. Thus, when the sum of the shares is below the critical ownership share for a single firm, a prevailing price rule would definitely provide an incentive for lower prices. In some cases, a prevailing price rule would provide an incentive to lower prices even when the sum of the shares exceeds the critical ownwership share. This would be the case when one or more of the affiliates has big enough share of the subscribers to prefer lower prices and the share of the other operators is not big enough for them to constitute a price-raising coalition. When none of the affiliates individually has a share above the critical ownership share but the affiliates as a group do constitute a price-raising coalition, then there is a risk that a prevailing price rule would provide an incentive to raise prices. Even then, the risk is mitigated by the possibility that some of the affiliates would respond to the price increase by dropping the network or, more plausibly, placing it in a higher tier.

VI

The Role of Advertising

The analysis so far has ignored the effect of price changes on the profits from sales to non-affiliates. While the assumption needed to justify this approach might appear technical, it can be stated in intuitive terms. Under some circumstances, the price that maximizes profits is higher than the price that some cable systems are willing to pay. Under others, it is optimal for a network to set a price so that it is carried by all cable systems. Under the former set of circumstances, a small change in the price of the network away from the price that maximizes profits from sales to non-affiliates has a negligible effect on those profits. Under the latter, a small change in the price (in either direction) would lower those profits. If a network's revenues came entirely from subscriber fees, it would generally choose a higher price than some cable operators are willing to pay. In fact, however, advertising provides slightly over 50% of a cable network's revenues.[20] Because of the way advertising is priced, it may indeed be optimal for cable networks to price low enough to be carried by all (or essentially all) cable operators. If so, then the above analysis understates the critical ownership share.

Advertisers pay cable networks on a per viewer basis. The price per viewer is an increasing function of the number of subcribers. A cable network that is received by 60 million homes gets a higher price per viewer than a cable network received by 30 million homes. The former would get greater advertising receipts from a show with a 1% share than the latter would get from a show with a 2% share even though the two shows would be seen by the same number

[20] "Cable TV Programming," Paul Kagan Associates, No. 193, May, 1994, pg. 1.

of people.[21]

To understand the importance of this point, first suppose that a cable system gets all of its revenues from subscriber fees. As is the case with virtually all goods, one would expect an inverse relationship between the price charged and the quantity demanded. One possibility is depicted in Figure 1a, which shows a demand curve that is linear from a quantity of 0 to 100%,[22] at which point it becomes vertical. The assumption that the demand curve is linear is made solely for analytical convenience. None of the substantive arguments that follow depend on it. The vertical segment requires some explanation. There are two mechanisms by which an increase in the price of a network can lower demand. First, it might induce some cable operators not to carry the network. Second, those operators who continue to carry the network would generally increase the price they charge consumers, which would in turn reduce the quantity demanded. As a practical matter, the first of these mechanisms is by far the more important. Indeed, the second is generally so small that it can be ignored. With the exceptions of ESPN and TNT, the price per subscriber charged by basic cable networks is less than $0.25, in most cases much less. A $0.05 increase in the fee would be a large percentage increase for most networks and a huge increase for some. The demand for cable is not elastic enough for a $0.05 increase in the price of basic cable service to affect demand very much. If networks were guaranteed continued carriage, it would surely make sense for them to raise their prices. At Q = 100%, all cable systems carry the network so further price reductions do not increase

[21] See Paul Kagan Associates, *Cable TV Advertising*, No. 224, January 31, 1994.

[22] In Figures 1 and 2, quantity is measured as a fraction of total cable households.

the number of subscribers.[23] In Figure 1a, three prices are indicated. The price at which demand drops to 0 is *P - 0%*. The price at which $Q = 100$ is denoted *P - 100%*. The third price shown is P^*, which corresponds to the quantity Q^*. Figure 1b shows the relationship between the quantity sold and subscriber revenues.[24] Q^* is the output that maximizes revenues. As pictured here, Q^* is less than 100%.

Figure 2 shows the relationship between advertising revenues and the number of subscribers.[25] The dashed line shows what the relationship would be if the price per viewer were constant. In that case, advertising receipts would increase proportionately to the number of subscribers. Because the price of advertising increases with the number of subscribers, however, advertising receipts rise more than proportionately with the number of subscribers. This relationship is captured by the solid curve.

Just as the relationship between the price of the network and the number of subscribers (Figure 1a) implies a relationship between subscriber revenues and the number of subscribers (Figure 1b), it also implies a relationship between subscriber revenues and the price of the network. This relationship is depicted in Figure 3b, where *P-0%*, *P-100%*, and P^* are the same

[23] The following discussion on the effect of advertising does not require that the demand curve becomes literally vertical at Q = 100. Rather, it requires that there is a "kink" at that point with the demand curve becoming nearly vertical.

[24] For analytical simplicity, assume that the marginal cost to a network of an additional subscriber is 0. Under this assumption, maximizing revenues is equivalent to maximizing profits. The fundamental argument of this section would still apply with positive marginal cost.

[25] The analysis here holds the audience share constant. In that case, the number of subscribers determines the number of viewers. In the long run, the audience share might depend on the number of subscribers. With more subscribers, a network would have more of an incentive to invest in the programming that would attract a larger audience share.

as in Figure 1a.[26] As Figure 3b shows, it would not be optimal to set a low enough price to get universal carriage if subscriber fees were the only source of revenue. Because of the relationship between the number of subscribers and the price of the network, Figure 2a implies a relationship between advertising revenues and *P*. This relationship is pictured in Figure 3c.[27]

Figure 3a shows the relationship between total revenues and *P* taking into account both subscriber fees and advertising revenues. It represents the vertical sum of Figure 3b and Figure 3c. The price of the network that maximizes profits from sales to non-affiliates is *P-100%*. In contrast to Figure 3b, the relationship between *P* and revenue is not flat at the maximum.[28]

Suppose that a cable operator's share of a cable network exceeded the critical ownership share analyzed in Section III. In that case, an increase in the network price above *P - 100%* would increase the cable operator's profits associated with sales of the network to itself. This increase would be offset, however, by a reduction in profits from sales to non-affiliated systems. The price increase would only be profitable if the increase in the operator's profits associated

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[26] In Figure 3b, the relationship between subscription revenue and the subscription price has a dashed segment to the left of *P-100%*. In this region, a price reduction does not increase the number of subscribers. As a result, revenue is directly proportional to the price. (The geometric implication of this point is that the dashed segment is a straight line. In the region ot the right of *P-100%*, the relationship between subscription revenues and the subscription fee is a curve.

[27] For prices below *P-100%*, advertising revenues are constant because the number of subscribers is constant.

[28] In technical terms, the difference between the maxima in Figures 3a and 3b is that the derivative of the revenue function is 0 in the latter but not in the former. When revenues are viewed as a function of quantity, subscriber revenues have an "interior optimum" while there is a "corner solution" to the output that maximizes revenues. When revenue is viewed as a function of price, the optimum is not literally a "corner," because the network could choose a lower price than the one that obtains 100% coverage. At that point, however, the "first derivative" of the revenue function is not continuous.

with sales to itself were greater than the reduction in its profits associated with sales of the network to unaffiliated systems. Thus, the 62% cut-off found in section IV is too low.

It would, of course, be desirable to quantify how much above 62% the cut-off is. To do so, one would need to know the size of the reduction in profits from increasing the price above *P - 100%*. In turn, one would need to estimate the elasticity of demand for individual cable networks. I know of no such estimates and have not attempted to estimate these demand elasticities myself. Despite this difficulty in quantifying it, though, the effect is empirically important. Several basic cable networks, such as CNN, ESPN, MTV, and TNT, have chosen prices to ensure carriage by virtually all cable systems. Such pricing is unusual. Cable operators (as distinct from cable networks) do not price for 100% penetration. Universal service would not be an important policy issue in the telephone industry if telephone companies could be expected to price in this way. But cable networks do.

When cable operators own more than what might be termed the "non-advertising critical ownership share" analyzed in Section IV, the profitability of price increases above *P - 100%* represents a trade-off between increased profits from sales to affiliated systems and decreased profits from sales to non-affiliated systems. The fraction of sales to each type of system affects this trade-off. Thus, for ownership shares above 62%, it is appropriate to take account of the fraction of sales to affiliates. While it would in principle be possible to do so based on a formal model, the resulting rule would be complicated and it would depend on parameters that are difficult to measure. In the conclusion, I suggest a simple alernative.

VII

Conclusion

In implementing the programming price pass-through provisions of its cable rate regulations, the FCC needs some method for estimating the cost of affiliate transactions. Absent any provision to prevent abuse, there is a risk that a cable operator will create the Time of Day Network, which consists of a camera perpetually focused on a clock, and charge itself a hefty subscription fee for carriage. It is completely appropriate for the FCC to impose regulations to prevent such practices. Far from creating an incentive for such abuse, however, a prevailing price rule would prevent it for most cable networks in which cable operators have an ownership interest.

The FCC's proposed rules are premised on a fundamental fallacy. They presume that a cable operator with a share in a cable network would care just as much about the network's profits as its own. It would not. Like virtually any purchaser of virtually any good, TCI would rather get CNN for a low price than for a high price. TCI's ownership share in Turner Broadcasting would soften the impact on it of an increase in the price of CNN. The opportunity to pass the price on to consumers would soften the impact more. But the direction of the impact would be the same.

The above analysis establishes a set of conditions under which a prevailing price rule clearly provides an incentive to lower prices. It then identifies some additional factors that imply that a prevailing price rule would be appropriate under a still broader set of circumstances. The most important of these factors is advertising. Because these additional factors are difficult to quantify, some judgment is necessary in deciding the precise conditions under which a prevailing price rule should prevail.

Whenever cable operators own less than 62% of a network, a prevailing price rule is appropriate. In principle, this is so as long as there are any sales to non-affiliates. In practice, the FCC should require that the sales to non-affiliates account for a substantial volume of commerce. A standard that 10% of subscribers be on non-affiliated systems should be sufficient.

Because the 62% cut-off would be appropriate for a network that relies entirely on subscriber fees and because advertising makes abuse of a prevailing price rule less likely, a prevailing price rule should be used in many cases where cable operators own more than 62% of a network. In such cases, it would appropriate to take account of the fraction of sales to non-affiliates. An *ad hoc* but easily implementable approach would be to use the prevailing price rule when the sum of the ownership share and share of affiliate transactions is below some critical level.

Under such an approach, the FCC would have to determine a cut-off. As was suggested above, a 62% ownership share would be the appropriate cut-off when affiliated systems account for up to 90% of subscribers. The sum of those two is 152%. Given the attraction of round numbers, a cut-off of 150% might be preferred. Alternatively, the current rules would allow a prevailing price rule with a 100% ownership share and up to 25% affiliated subscribers. That would imply a cut-off for the sum of 125%. In my opinion, a number of factors make the higher number more appropriate. First, the 25% standard is adopted from the telephone industry, where advertising plays no role. Since advertising reduces the risk that a prevailing price rule could be abused, some increase over a 125% cut-off would be appropriate. In addition, as is described in my companion report, the alternative rule proposed by the FCC is particularly flawed. As a result, some risk that a prevailing price rule would be abused should be tolerated. In my judgment, therefore, the appropriate cut-off is 150%.

Technical Appendix

Quantifying the Critical Share Value

This appendix derives formally the conditions under which an affiliated cable operator would try to influence a cable network to lower its price given a "prevailing price" rule for affiliate transactions.

Let p be the price per subscriber charged by the network to cable operators and p^* be the price that maximizes the network's profits from sales to non-affiliated cable operators.[29] If the cable regulations restrict the price that cable operators can charge and if cable operators are allowed to pass through any increase in programming prices to consumers, then a small increase in p above p^* would increase the joint profits of the cable operator and the network. Such an increase lowers the profits of the cable operator from its cable operations, however, because the pass-through provision simply allows it to maintain its margin while the price increase reduces demand. Joint profits go up because the increase in the network's profits exceed the reduction in profits at the cable stage.

Whether or not the cable operator benefits from this increase turns on whether it owns a sufficiently large share of the cable operator. Let s be the fraction of the equity in the cable network owned by the cable operator ($0 \leq s \leq 1$). Let t be ratio of the reduction in the cable operator's cable profits to the increase in the network's profits from a small increase in p above p^*. Because joint profits go up, $t < 1$. The cable operator benefits from a price increase if

[29] This price can be taken as a proxy for the price that would prevail if the affiliate divested itself of its interest in the network.

$s > t$, benefits from a price decrease if $s < t$, and prefers to keep $p = p^*$ if $s = t$.

Let π_c be the cable operator's profits from its cable operations and π_n be the network's profits from selling to the affiliated cable operator.[30] If P is the price charged by the cable operator to subscribers and Q is the number of subscribers, then:

$$\pi_c(P,p) = Q(P)[P-c-p] \tag{1}$$

$$\pi_n(P,p) = pQ(P) \tag{2}$$

where c is the constant marginal cost of an additional subscriber to the cable network (other than the additional subscriber fee paid to the network in which it has an ownership interest). Most of this marginal cost would consist of subscriber based programming costs.[31]

In the above informal argument about the critical ownership share, it was assumed that a cable operator can pass programming costs on to subscribers dollar for dollar. In fact, cable operators are allowed to add a 7.5% mark-up. More generally, if Θ is the allowed mark-up, the price a cable operator is allowed to charge can be written as:

[30] Under a prevailing price rule, a cable operator could only change the price charged to the affiliated cable operator by changing the price to unaffiliated operators. (To be more precise, a prevailing price rule would mean that a cable network could not charge its affiliated networks any more than it charges unaffiliated networks. Equal access regulations would, however, prevent it from charging any less.) Because p^* is the price that would maximize the network's profits from sales to non-affiliated systems, however, a small change in p in the vicinity of p^* does not affect these profits. As a result, sales to non-affiliates can be ignored for the purpose of determining the qualitative effect of affiliation on pricing.

[31] Both π_n and π_c are net of any fixed costs, which can be ignored for the analysis that follows. Equation (2) embodies the assumption that all of the network's costs are fixed with respect to sales to the number of its affiliated cable system's subscribers.

$$P = K + (1 + \theta)p \tag{3}$$

where K is a constant.[32] Thus, $dP/dp = 1 + \Theta$.

The cable operator's total profits, π, can be written as:

$$\pi(P,p) = \pi_c(P,p) + s\pi_n(P,p) \tag{4}$$

The derivative of its profits with respect to p is, therefore,

$$\frac{d\pi}{dp} = \frac{\partial\pi_c}{\partial p} + \frac{\partial\pi_c}{\partial P}\cdot\frac{dP}{dp} + s\cdot\left(\frac{\partial\pi_n}{\partial p} + \frac{\partial\pi_n}{\partial P}\cdot\frac{dP}{dp}\right) \tag{5}$$

To formalize the intuitive argument made above, the sign of $d\pi/dp$ is determined by:

$$\frac{d\pi}{dp} \overset{>}{\underset{<}{=}} 0 \leftrightarrow s \overset{>}{\underset{<}{=}} -\frac{\dfrac{\partial\pi_c}{\partial p} + \dfrac{\partial\pi_c}{\partial P}\cdot\dfrac{dP}{dp}}{\dfrac{\partial\pi_n}{\partial p} + \dfrac{\partial\pi_n}{\partial P}\cdot\dfrac{dP}{dp}} \equiv t \tag{6}$$

From (1) and (2), it follows that:

$$\frac{\partial\pi_c}{\partial p} = -Q \tag{7}$$

$$\frac{\partial\pi_c}{\partial P} = Q + [P - c - p]\frac{dQ}{dP} = Q[1 + \frac{P - c - p}{P}\eta] \tag{8}$$

$$\frac{\partial\pi_n}{\partial p} = Q \tag{9}$$

[32] K might be a function of prices charged by other networks, but these are assumed to be outside the cable system's control. Also, K might change over time.

$$\frac{\partial \pi_n}{\partial P} = p\frac{dQ}{dP} = Q\frac{p}{P}\eta \tag{10}$$

Let s_c be the critical value of s for which equation $d\pi/dp$ equals 0 and suppose that $p = p^*$. Substituting equations (7) to (10) into (6) and using the result that $dP/dp = 1 + \Theta$ yields:

$$s_c = -\frac{\theta + \left(\frac{P - c - p^*}{P}\right)\cdot(1+\theta)\cdot\eta}{1 + \left(\frac{p^*}{P}\right)\cdot(1+\theta)\cdot\eta}. \tag{11}$$

Let P' be price of basic service that would maximize the joint profits of the network and the cable operator's cable operations (i.e., $\pi_c + \pi_n$). Equation (11) can be rewritten as:

$$\begin{aligned} s_c &= -\frac{\theta + \left(\frac{P'}{P}\right)\cdot\left(\frac{P-c-p^*}{P'}\right)\cdot(1+\theta)\cdot\eta}{1 + \left(\frac{p^*}{P'}\right)\cdot\left(\frac{P'}{P}\right)\cdot(1+\theta)\cdot\eta} \\ &= -\frac{\theta + \left(\frac{P'}{P}\right)\cdot\left[\left(\frac{P' - c}{P'}\right) + \left(\frac{P - P'}{P'}\right) - \left(\frac{p^*}{P'}\right)\right]\cdot(1+\theta)\cdot\eta}{1 + \left(\frac{p^*}{P'}\right)\cdot\left(\frac{P'}{P}\right)\cdot(1+\theta)\cdot\eta} \end{aligned} \tag{12}$$

Let R be the regulated price divided by the price that would maximize the joint profits of the cable operator and the network (P/P') and H be the price the cable operator would like to charge to non-affiliates divided the profit-maximizing price (p^*/P'). With these definitions, (12) can be rewritten as:

$$s_c = -\frac{\theta + \left(\frac{1}{R}\right)\cdot\left[\left(\frac{P' - c}{P'}\right) - (1 - R) - H\right]\cdot(1+\theta)\cdot\eta}{1 + \left(\frac{H}{R}\right)\cdot(1+\theta)\cdot\eta}. \tag{13}$$

Because P' maximizes joint profits, a well-known condition for profit-maximization implies (P' - c)/P' = $-1/\eta_m$, where η_m is the elasticity of demand at the joint profit-maximization price P'. Substituting this condition into (13) and rearranging yields:

$$s_c = \frac{-\left(\frac{\theta\cdot R}{(1+\theta)\cdot\eta}\right) + \left(\frac{1}{\eta_m}\right) + H + (1 - R)}{\left(\frac{R}{(1+\theta)\cdot\eta}\right) + H}. \tag{14}$$

Equation (14) is the basis for Tables 1 and 2. In Table 1, $\Theta = 0$ and in Table 2, $\Theta =$ .075.